

A. K. TRIPATHI\* & S. N. PANDEY\*\*: **A note on the taxonomy  
of *Arthrospira* and its new species *A. intermedia*  
(Cyanophyceae) from India**

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フシラセンモ属の分類と 1 新種

In the family Oscillatoriaceae, there are three genera viz., *Oscillatoria* Vaucher, *Arthrospira* Stizenberger and *Spirulina* Turpin em. Gardner. *Oscillatoria* was considered as an independent genus since long but there was a controversy regarding *Arthrospira* and *Spirulina*. Geitler (1932) recognized the genus *Spirulina* and divided it into two sections viz., Euspirulina and *Arthrospira*. At present (Desikachary 1959), however, *Arthrospira* and *Spirulina* are treated as independent genera. So far as *Oscillatoria* is concerned there are certain species which also share the character of *Arthrospira*. The present paper deals with the distinction between *Oscillatoria* and *Arthrospira* and an interesting new species of *Arthrospira*. A Camera Lucida diagram and a photograph of the new taxon are given to facilitate easy identification.

***Arthrospira intermedia*** Tripathi et Pandey, sp. nov.

Trichotomata 100–150  $\mu\text{m}$  longa, cyaneo-viridia, ordinatim spiratim circinata, plerumque stricta vel leviter flexa, haud constricta, 3–4  $\mu\text{m}$  lata; spirae 4.5–6  $\mu\text{m}$  latae, 32–36  $\mu\text{m}$  semotae; cellulae parvae, 2–3  $\mu\text{m}$  longae, sine valuolae gaseosae; septa non granulata; cellulae extremae rotundatae, leviter attenuatae; calyptrae absentes.

Habitatio: Libere natantia piscina Kalyanpurensis tempore menses August et September 1983.

Iconotypus: Figurae 1, A–C & 2.

The new species is similar to *Arthrospira gomontiana* Setchell in respect of the broadness of spirals as well as trichomes but can be easily distinguished in having 1) spirals more distant, 2) cells shorter in length and 3) cross walls not granulated. It resembles *Arthrospira gomontiana* Setchell var. *crassa*

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Gupta, in the breadth of trichomes and the length of cells but differs in 1) spirals less broad and 2) spirals more distant. The new taxon comes closer to *Arthrospira joshii* Vasishta, in the length of cells and cross walls not granulated but differs in 1) spirals less broad, 2) spirals more distant, 3) trichomes less broad and 4) absence of gas-vacuoles. It comes closer to *Arthrospira massartii* Kuffareth in the following respects: 1) length of cells, 2) cross walls not granulated and 3) absence of gas-vacuoles but differs in possessing 1) narrower trichomes and 2) narrower distance and magnitude of spirals.

The present species is based on the character having narrower dimensions

and distance of the spirals as compared to *A. massartii* Kuffareth, while the distance of spirals is just about twice in comparison to other taxa, *A. gomontiana*, *A. gomontiana* var. *crassa* and *A. joshii*. Thus, this species is placed in between these two

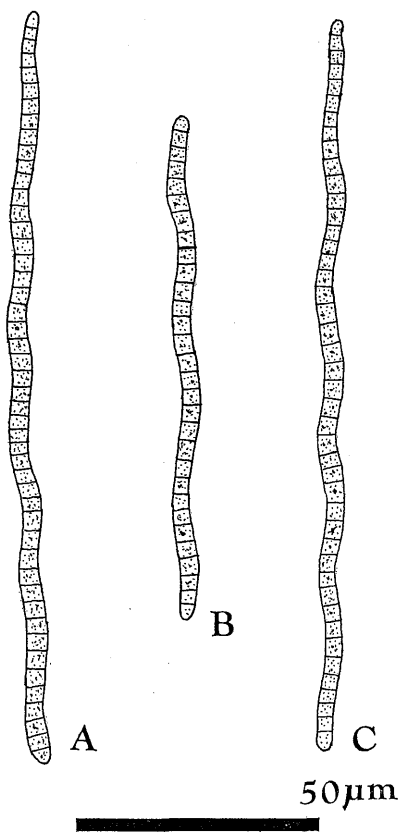


Fig. 1. A-C. *Arthrospira intermedia* Tripathi et Pandey, sp. nov.  $\times 806$ .

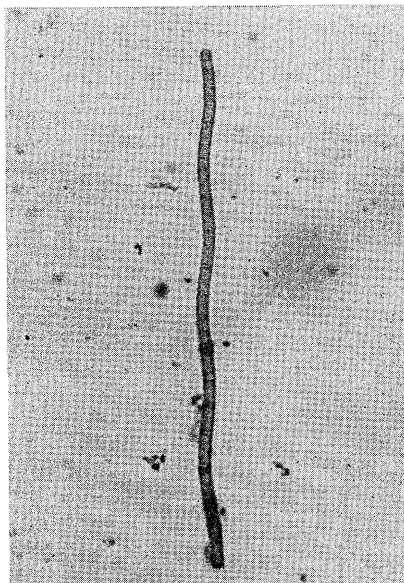


Fig. 2. *Arthrospira intermedia* Tripathi et Pandey, sp. nov.  $\times 500$ .

groups of *Arthrospira* and named *Arthrospira intermedia*.

**Discussion** During the course of studies of algal flora of certain polluted ponds of Kanpur there was a problem on the name of a taxon, which has been later on identified as *Arthrospira intermedia*, sp. nov. Some members of *Oscillatoria* such as *O. boryana*, *O. martini* and *O. formosa* f. *loktakensis* show spirally coiled trichomes, a character of *Arthrospira*. Vasishta (1963) compared *O. martini* with *A. massartii* and found that these two resemble each other in having 1) spirally coiled trichomes, 2) similar dimensions of the trichomes, 3) similar length of cells, and 4) absence of gas-vacuoles and septa not granulated but the former differs from the latter in slight attenuation of the trichomes and the presence of calyptra. It has also been mentioned by him (Vasishta 1963) that the trichomes of *A. massartii* seem to be attenuated at the ends as it appears in the figures drawn by Kuffareth (Desikachary 1959) and in *A. massartii* var. *indica* Desikachary the presence of calyptra has been recorded. Desikachary (1959) in his monograph mentioned that in *Arthrospira* calyptra is absent but he created a new variety, as mentioned above (*A. massartii* var. *indica*), having calyptra. Thus these two different types of statement created a problem to separate *Arthrospira* from *Oscillatoria*. After a comparison of *Arthrospira* with *Oscillatoria*, Vasishta (1963) remarked that "There seems to be no justification in separating *Arthrospira* from *Oscillatoria*. The septate, non-sheathed, spirally coiled trichomatous forms of the *Oscillatoria*-ceae can be put under the genus *Oscillatoria* without incurring any phylogenetic or taxonomic aberration." However, in the same paper, he (Vasishta 1963) created five new species, including *Arthrospira joshii* and *Oscillatoria mehrai*, and treated *Arthrospira* and *Oscillatoria* as separate genus. This contradictory line of thinking in the same paper indicated that his argument for submission of *Arthrospira* with *Oscillatoria* is not complete because he himself (Vasishta 1963) did not follow on his own argument and he left the problem by stating that "... it would be premature to make any concrete taxonomic suggestions in this paper."

Literature shows that the trichomes of some species of *Oscillatoria* are either bent or curved or spirally coiled only at the apices. This should be used as a character of the genus *Oscillatoria*. Those species of *Oscillatoria* which show spiral like twisting only at the ends of their trichomes are *O. ornata*, *O. curviceps*, *O. anguina*, *O. proboscidea*, *O. grunowiana*, *O. willei*, *O. trebriformis*,

*O. boryana* and *O. chalybea*. The authors consider that *Arthrospira* is distinct from *Oscillatoria* in having spiral coiling spreaded throughout the length of trichomes and this feature can be used as a diagnostic criterion. It may be added here that on a similar ground (for practical convenience) Setchell & Gardner (1919) had segregated *Arthrospira* from *Spirulina*.

Vasishta (1963) doubted *O. deflexa* W. et G.S. West as a species of *Arthrospira* but the description of *O. deflexa* (Desikachary 1959) shows that "Trichomes single, or arranged in spirally coiled bundles, ...." It does not mean that a single trichome of *O. deflexa* is spirally coiled but the bundles of the alga is in spiral manner. Geitler's (1932) drawing do not show spiral trichomes for the alga and thus no question arises about its validity.

Geitler (1932) mentioned as follows about three species of *Spirulina* (under the section *Arthrospira*) which appeared at first instance as the members of *Oscillatoria*. The trichomes of *Spirulina curta* (Lemmermann) Geitler are half S-shaped. Those of *S. breviarticulata* (Setch. et Gardner) Geitler are more or less spirally coiled throughout the length but not in a regular manner. The trichomes of *S. schroederi* Koppe are straight and uncoiled at the apices while in the middle regularly spiral. On the basis of the spiral trichomes, Geitler (1932) placed these species in the genus *Spirulina* (section *Arthrospira*).

Certainly, there is a problem about the placement of some species of *Oscillatoria* viz., *O. martini*, *O. boryana* and *O. formosa* f. *loktakensis*. The trichomes of these species do not show a regular manner of spirals though they are not straight but distinctly spiral throughout the length of trichomes. The authors feel that this character, i.e. the spiral nature of trichomes, is sufficient to assign these taxa to the genus *Arthrospira*, however, they appear to occupy an intermediate position between *Arthrospira* and *Oscillatoria*. In the same line the authors are of humble opinion that the species of *Oscillatoria* which show the spiral nature throughout the length should be transferred to the genus *Arthrospira*.

***Arthrospira martini*** (Frémy) Tripathi et Pandey, comb. nov.

Basionym. *Oscillatoria martini* Frémy in Myxo. d'Afr. équat. franc., 230, fig. 203, 1929.

The trichomes of *O. martini* Frémy are spirally coiled throughout the length. This species should be treated as a separate species from *A. massartii* because it has calyptrate trichomes.

var. **indica** (Desikachary) Tripathi et Pandey, comb. nov.

Basionym. *Arthrospira massartii* Kuffareth var. *indica* Desikachary in Cyanophyta, 191, pl. 35, figs. 7-8, 1959.

*A. massartii* Kuffareth var. *indica* Desikachary is to be transferred to *A. martini* (Frémy) Tripathi et Pandey, because this taxon shows the presence of calyptra, and it comes closer to the species *A. martini* (Frémy) Tripathi et Pandey.

**Arthrospira boryana** (Bory ex Gomont) Tripathi et Pandey, comb. nov.

Basionym. *Oscillatoria boryana* Bory ex Gomont in Bory, Dict. class, d'hist, nat., 12: 465, 1827.

According to Desikachary (1959), the trichomes are either coiled as screw-like or bent at the apices or somewhat straight. The authors are of opinion that this variable nature stated for this taxon might be caused by the observation of a mixture of different algae. Vasishta (1963) states that "There are instances where the trichomes are spirally coiled in one region and straight or bent in the rest of the portion. I have often observed the hormogones of *Arthrospira* germinating to give rise to straight *Oscillatoria* like trichomes, e.g. in *Arthrospira khannae* Drouet et Strickland, *A. platensis* (Nordst.) Gomont and *A. joshii* Vasishta."

**Arthrospira loktakensis** (Bruhl et Biswas) Tripathi et Pandey, comb. nov.

Basionym. *Oscillatoria formosa* Bory ex Gomont f. *loktakensis* Bruhl et Biswas in Algae of the Loktak Lake, Mem. Asiatic Soc. Bengal, n.s., 8: 264, pl. 1, fig. 5, 1926.

The figure drawn by Biswas (in Desikachary 1959) shows that the trichome *O. formosa* f. *loktakensis* is spirally coiled and, therefore, it should be transferred to *Arthrospira* as a separate species, *A. loktakensis*.

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インド産の材料に基づいて藍藻フシラセンモ属 (*Arthrospira*) の分類学的研究を行った。この属は細胞系全体がコイル状に巻く形質により特徴づけられ、この形質により近似のユレモ属 (*Oscillatoria*) との区別は容易である。上記の定義に基づき両属の中間的な性質を示す藍藻の1種を新種 *Arthrospira intermedia* Tripathi et Pandey として記載し、さらに次の3種1変種の新組合せを行った。*Arthrospira martini* (Frémy) Tripathi et Pandey, *A. martini* (Frémy) Tripathi et Pandey var. *indica* (Desikachary) Tripathi et Pandey, *A. boryana* (Bory ex Gomont) Tripathi et Pandey および *A. loktakensis* (Bruhl et Biswas) Tripathi et Pandey.

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□葛谷 孝：八甲田の花 190 pp. 1987. 北の街社，青森。¥2,500. カラーガイドブックと題して八甲田山へ登る植物好きの人を対象にした手引書である。樹林帯・高山帯・湿原の3項目に分けてあり、山登りしながら簡単に植物がわかる。高山植物を中心に127種をカラー写真203枚にまとめているが、生態ありアップありで植物の特徴がよく捉えられていて、印刷も美しい。発行所の宛先は青森市本町 1-5-43. (伊藤 洋)

□林 弥栄・畔上能力・菱山忠三郎・西田尚道：秋の山野草と樹木505種(マイフルール・シリーズ) 251pp. 1987. 講談社，東京。¥2,200. 春・夏・秋の3部で完結したこの山野草ガイドブックは「類似種比較」と「ワンポイント検索図解」を特色としているが、各巻約900点のカラー写真とカラー図版が見事な出来で、初心者にわかりやすく、見るだけでも楽しい。また指導者にとっても参考になることが多く、便利な図鑑である。(伊藤 洋)